

Major Petroleum Facility and Central Steam Facility

Facility Environmental Monitoring Report

Calendar Year 2002



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Prepared by
D. Paquette, J. Williams, R. Lee, and M. Allocco
Environmental and Waste Management Services Division

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Summary of Results

Analysis of environmental samples collected at the Major Petroleum Facility and Central Steam Facility during 2002 indicates that current operations are not impacting air or groundwater quality.

Although no fuel-related chemicals were detected in the groundwater, the chemicals tetrachloroethylene and 1,2-dichloroethene were detected in several Major Petroleum Facility wells at concentrations exceeding New York State water quality standards. 1,2-dichloroethene is a breakdown product of tetrachloroethylene. These contaminants probably originate from an historical solvent spill near the Central Steam Facility.

Continuous emission monitoring data and No. 6 fuel oil analytical sample results collected during 2002 confirm that the four boilers at the Central Steam Facility are fully compliant with applicable nitrogen oxide (NO_x) emission standards and with NYSDEC operating permits. Periodic exceedances of the opacity standard measured by the continuous opacity monitor for Boiler 7 occurred during monitoring system calibrations, boiler start-ups, and routine boiler maintenance intervals.

Soil samples collected in October 2001 at SPDES Outfall 010 had lead concentrations ranging from 2,120 mg/Kg to 55,200 mg/Kg. These concentrations exceed the 400 mg/Kg Action Level for soil cleanup established by the Suffolk County Department of Health Services. Available information suggests that the lead observed in the soils originates from water washing of ash/slag buildup in the boilers from the mid 1970s through the early 1980s. Wastewater generated by this process was discharged to the CSF floor drains, which until the early 1980's discharged to the storm water collection system. During 2002, significant effort was made to fully delineate the area of lead contamination. This effort included the collection and analysis of approximately 150 soil samples. An area of lead contamination extending approximately 1,200 feet east – west and approximately 50 feet north - south was defined. A remedial action plan was prepared that is currently under review by the regulatory agencies.

Background

The Major Petroleum Facility (MPF) is the holding area for fuels used at the Central Steam Facility (CSF). Fuel oil for the CSF is held in a network of seven aboveground storage tanks. The tanks, which have a combined capacity to contain up to 1.7 million gallons of #6 fuel oil and 660,000 gallons of #2 fuel oil, are connected to the CSF by aboveground pipelines that have secondary containment and leak detection devices. All fuel storage tanks are located in bermed containment areas that have a capacity to hold >110 percent of the volume of the largest tank located within each bermed area. The bermed areas have bentonite clay liners consisting of either Environmat (bentonite clay

sandwiched between geotextile material) or bentonite clay mixed into the native soils to form an impervious soil/clay layer. As of December 1996, all fuel unloading operations were consolidated in one centralized building that has secondary containment features. The MPF is operated under New York State Department of Environmental Conservation (NYSDEC) license #1-1700. As required by law, a Spill Prevention Control and Countermeasures Plan and a Facility Response Plan have been developed for the facility (BNL, 2000; BNL, 2002b).

The CSF uses four boilers to supply steam for heating and cooling to BNL major facilities through an underground steam distribution and condensate grid. To control emissions of nitrogen oxides (NO_x), a pollutant that contributes to the formation of ozone in the lower atmosphere, both US EPA and NYSDEC have enacted regulatory requirements that restrict NO_x emissions from large and midsize boilers. The CSF uses a combination of engineering and administrative controls to comply with applicable NO_x emission standards.

For Boilers Nos. 1A and 5, compliance with the NO_x emission standard of 6 NYCRR Part 227-2 is achieved through the use of low-excess air burners. Initial compliance with this standard was demonstrated through stack testing conducted in January 1995 while each boiler burned No. 6 oil with fuel nitrogen and sulfur contents of less than 0.3 percent. To help to ensure compliance with the NO_x limits, all CSF contracts with No. 6 oil suppliers specify that No. 6 oil delivered to the MPF have a nitrogen content not greater than 0.3 percent by weight.

In addition to the emission limits of 6 NYCRR Part 227-2, Boiler Nos. 6 and 7 must comply with NO_x emission limits of New Source Performance Standard, 40 CFR 60 Subpart Db. Boiler No. 7 must also comply with 40 CFR 60 Subpart Db, stack opacity monitoring requirements. Both boilers use dual fired low NO_x burners to meet the emission standards. To demonstrate initial compliance with the Subpart Db standard, stack tests were conducted on Boilers 6 and 7 in October 1991 and May 1996 respectively. In accordance with Subpart Db requirements, NO_x continuous emission monitors are used on both boilers and a continuous opacity monitoring system is used on Boiler 7 to ensure continuous compliance with the NO_x and opacity standards.

Environmental Monitoring Program

BNL has established air, groundwater, and stormwater discharge monitoring programs at the CSF and MPF to evaluate potential impacts to environmental quality and to demonstrate compliance with DOE requirements and applicable federal, state, and local laws, regulations, and permits. Monitoring requirements are described in the NYSDEC License (see Desmarais, 2002) and summarized in the *BNL Environmental Monitoring Plan* (BNL, 2002a).

Monitoring Results

Air

The primary objective of air monitoring efforts at the CSF is to verify compliance with applicable federal and state NO_x emission and opacity standards. This is accomplished either through periodic monitoring of residual fuel deliveries to the MPF, surveillance monitoring of visible stack emissions from Boilers 1A, 5 and 6, or continuous monitoring of NO_x and opacity emissions through monitoring ports in stacks for Boilers 6 and 7. Monitoring results were provided to NYSDEC on a quarterly basis (Cunniff, 2002a; Cunniff, 2002c; Cunniff, 2002d; Zimmerman, 2003)

Since there are no continuous emissions monitoring requirements for Boilers 1A and 5, the CSF uses the measured nitrogen content from composite samples of No. 6 fuel deliveries to the MPF during the quarter as a surrogate indicator for compliance with NO_x emission standards. Continued compliance with the emission standard is presumed so long as laboratory analysis of composite residual fuel samples confirms the fuel nitrogen content does not exceed 0.3 percent by weight. Analysis of composite samples of residual fuel oil deliveries to MPF storage tanks during each quarter of CY 2002 confirmed that the fuel bound nitrogen content of No. 6 oil burned was less than 0.3 percent by weight.

While there are no regulatory requirements for continuous monitoring of opacity for Boilers 1A, 5, and 6, surveillance monitoring of visible stack emissions is conducted daily by CSF on-duty personnel. Daily observations of stack gases recorded throughout the year in accordance with conditions of BNL's Title V operating permit showed no visible emissions with opacity levels exceeding regulatory limits established for these boilers.

From May 1 to September 15 (the peak ozone period), compliance of Boilers 6 and 7 with the NO_x emissions limits was demonstrated by calculating the 24-hour average emission rate from continuous emission monitor readings, and comparing this value to the emission standards (0.30 lbs/MMBtu for oil and 0.20 lbs/MMBtu for gas). For the remainder of the year, the calculated 30-day rolling average emissions rate was used to establish compliance. In CY 2002, there were no measured exceedances of the NO_x emission standard for either boiler. For the year, NO_x emissions from Boiler 6 averaged 0.233 lbs/MMBtu when No. 6 oil was burned and 0.080 lbs/MMBtu for natural gas. Similarly, the annual average NO_x emissions recorded by the continuous emission monitors on Boiler 7 when No. 6 oil and natural gas were burned were 0.243 lbs/MMBtu and 0.0103 lbs/MMBtu, respectively.

Boiler 7 flue gas opacity is measured by a transmissometer mounted on the stack above the CSF roofline. Opacity readings are taken at 15-second intervals and reported as 6-minute averages. Measured opacity levels cannot exceed 20 percent opacity, except for one 6-minute period per hour of not more than 27 percent opacity. Excess opacity measurements recorded in the first, third, and fourth quarters occurred during opacity monitoring system calibrations, boiler start-ups, or during routine boiler tube soot blowing operations.

Groundwater

The MPF's groundwater monitoring program is designed to confirm that the engineered and institutional controls in place are effective in preventing contamination of the aquifer. During 2002, groundwater quality in the MPF area was monitored using eight wells (076-16, 076-17, 076-18, 076-19, 076-25, 076-378, 076-379, and 076-380). The locations of the monitoring wells are shown on Figure 1.

Groundwater contaminants from the fuel oil products stored at the MPF can travel both as free product and in dissolved form with advective groundwater flow. Historically, the Special License Conditions for the MPF required the groundwater monitoring program to include semiannual sampling for semivolatile organic compounds (SVOCs) and monthly monitoring for floating petroleum. In early 2002, NYSDEC expanded the required analysis list for the MPF wells to include volatile organic compounds (VOCs), including testing for MTBE. Although MTBE is a common gasoline additive, it can apparently be introduced to fuel oil as a contaminant during the refining process.

In April 2002, BNL sampled the MPF wells and tested the samples for SVOCs and VOCs in accordance with the new permit requirements. As in the past, no SVOCs were detected, and no floating product was observed (Cunniff, 2002b; Zimmerman, 2002). However, VOCs were detected in two wells (076-19 and 076-380) at concentrations exceeding the New York State Ambient Water Quality Standard of 5 ug/L (or 5 parts per billion). The compounds detected in well 076-380 were 1,2-dichloroethene (*total*) at 300 ug/L, tetrachloroethene at 36 ug/L, and trichloroethylene at 8.3 ug/L. The compound 1,2-DCE was also detected in nearby well 076-19 at a concentration of 16 ug/L. (Please note that 1,2-dichloroethene is a breakdown product of the common degreasing agent tetrachloroethylene.) Following the receipt of the analytical data that indicated elevated VOC concentrations in well 076-380, BNL upper management, DOE, and regulatory agencies were notified of the findings in accordance with the BNL Groundwater Protection Contingency Plan (Level 2 response), and a technical team was established to evaluate the source of the contamination (see discussions in Paquette, 2002a, b, c, and d).

BNL increased the sampling frequency for well 076-380, as well as several nearby monitoring wells. Evaluation of these monitoring data indicates that 1,2-DCE contamination extends as far south as well 076-185. In May 2002, 1,2-DCE was detected in well 076-185 at a concentration of 26.6 ug/L. This is a shallow well that is approximately 350 feet south of wells 076-380 and 076-23. During the remainder of the year, 1,2-DCE concentrations in well 076-380 increased to a high of 566 ug/L in June, then steadily decreased to nondetectable levels by October (Figure 2). Tetrachloroethylene concentrations also dropped to nondetectable levels by October; however, trichloroethylene concentrations increased slightly to 20 ug/L.

Based on an evaluation of groundwater flow directions and modeling, it is likely that the VOC contamination originates from the CSF (Bldg. 610) area (see Paquette, 2002d). Although a source for the VOCs cannot be definitely identified, the VOCs are likely to have originated from an historical spill near Bldg. 610. The historical nature of this spill

is supported by: 1) degreasing agents such as tetrachloroethene have not been used at the CSF in many years; 2) tetrachloroethene has been detected in well 076-19 since the early 1990s; and 3) the presence of 1,2-dichloroethene, which is a breakdown product of tetrachloroethene. A number of historical spill sites near Bldg. 610 were identified in the late 1990s, and the most contaminated soils were subsequently excavated in accordance with regulatory requirements. In an effort to identify the source of the contamination, in early 2003 BNL will install four temporary Geoprobe wells downgradient of the suspected source areas near Bldg. 610.

SPDES Monitoring

Storm water from the MPF/CSF area is discharged to an outfall located approximately 900 feet east of Bldg. 610. This discharge is regulated under the BNL State Pollutant Discharge Elimination System (SPDES) permit, Outfall 010. This discharge point receives stormwater runoff from the area around the CSF, North 6th Street east of the CSF, and Cornell Avenue north of the CSF. Historical surveillance monitoring of the discharge revealed sporadic detections of lead above the NYS groundwater discharge standard of 50 ug/L. In 2000/2001, an area of lead contaminated soils was discovered at the outfall. Resuspension of the contaminated soils at the outfall during sample collection was identified as the probable cause for the periodic discharge violations. In February 2002, NYSDEC added lead monitoring as a condition of the BNL SPDES permit for this outfall. During 2002, the effluent standard for lead was exceeded on two occasions. To mitigate further violations, a geotextile was installed at the outfall to prevent resuspension of contaminated soils. Based on subsequent effluent analyses, the installation of the textile has been successful as a temporary measure to mitigate resuspension of soils and prevent future SPDES violations.

In 2002, an additional 150 soil samples were collected to define the lateral and horizontal extent of lead contamination. The investigation has shown that soil samples as far as 1,200 feet away from the outfall have been impacted to above-background levels. A remedial action plan has been prepared that proposes to remove all soils with lead concentrations greater than 1,200 mg/Kg, a residential standard founded in TSCA legislation. This plan is currently under regulator review. Once remediated, the area would be lined with geotextile and backfilled. Rock would be placed at the outfall to minimize further soil erosion.

During the mid 1970s through the early 1990s, the Laboratory participated in an alternate liquid fuels (ALF) program. This program consisted of purchasing various types of fuel or other combustible liquids from governmental agencies and the private sector. These fuels were stored and mixed with residual fuel and burned at the CSF. The fuels were composed of waste oils, jet fuel, and waste organic solvents. A review of available documentation for the ALF program shows that the fuel had lead concentrations up to 300 ppm. The fuels were blended with virgin No. 6 fuel oil in quantities to produce a product similar in characteristics to No. 4 fuel. Due to the waste nature of some of the ALF products, ash/slag buildup in the boilers was heavier than normal and required frequent removal via water washing. All wastewater generated by this process was discharged to the CSF floor drains. Until the early 1980's, the floor drains discharged to

the stormwater collection system. The floor drains were subsequently redirected to the BNL sanitary sewer. This wastewater most likely contained elevated metals, due to the high levels contained in the waste oils. Elevated levels of vanadium detected in soil samples collected at the headwall are indicative of a fuel-based source, which further supports the supposition that the boiler wash water is the most likely source of the lead and other inorganic contaminants.

Future Monitoring Actions

The following actions are recommended for CY 2003:

- Maintain the groundwater monitoring program on its current semiannual schedule in accordance with NYSDEC requirements.
- Install four Geoprobe wells downgradient of suspected VOC source areas.
- Maintain the air monitoring program on its current schedule as required by the NYSDEC license.
- Continue SPDES monitoring and collect additional soil samples as part of the remedial action associated with the CSF/MPF storm water outfall.

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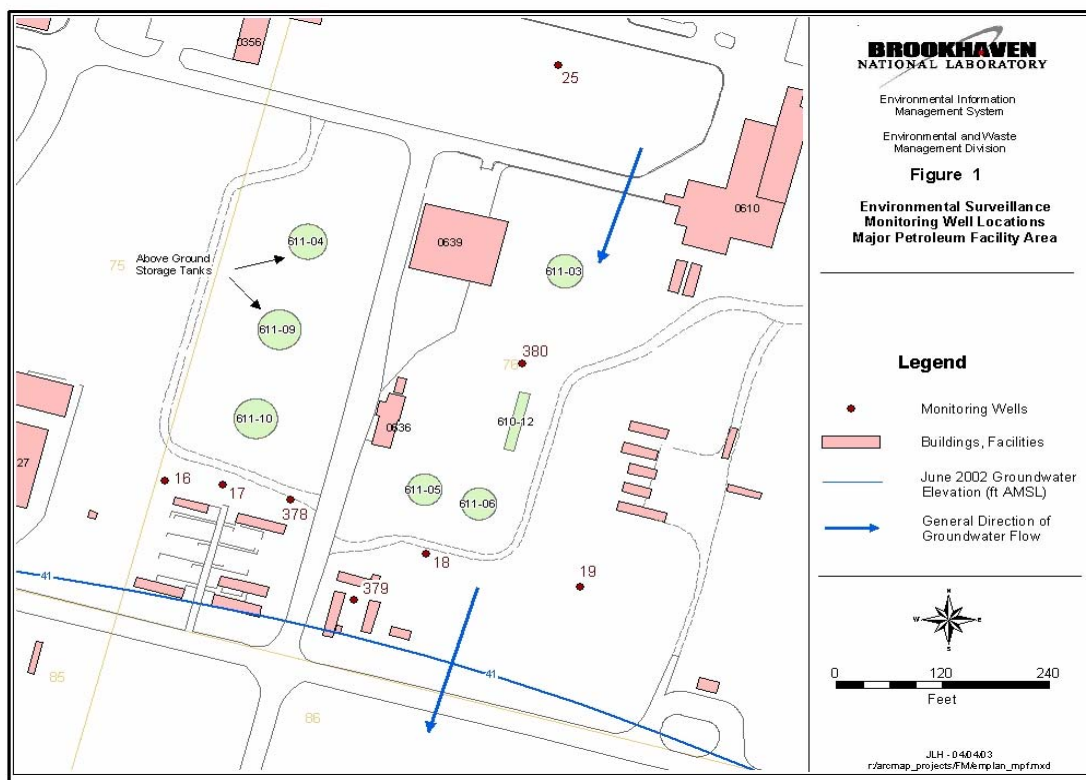


Figure 1. Locations of BNL Groundwater Monitoring Wells at the MPF.

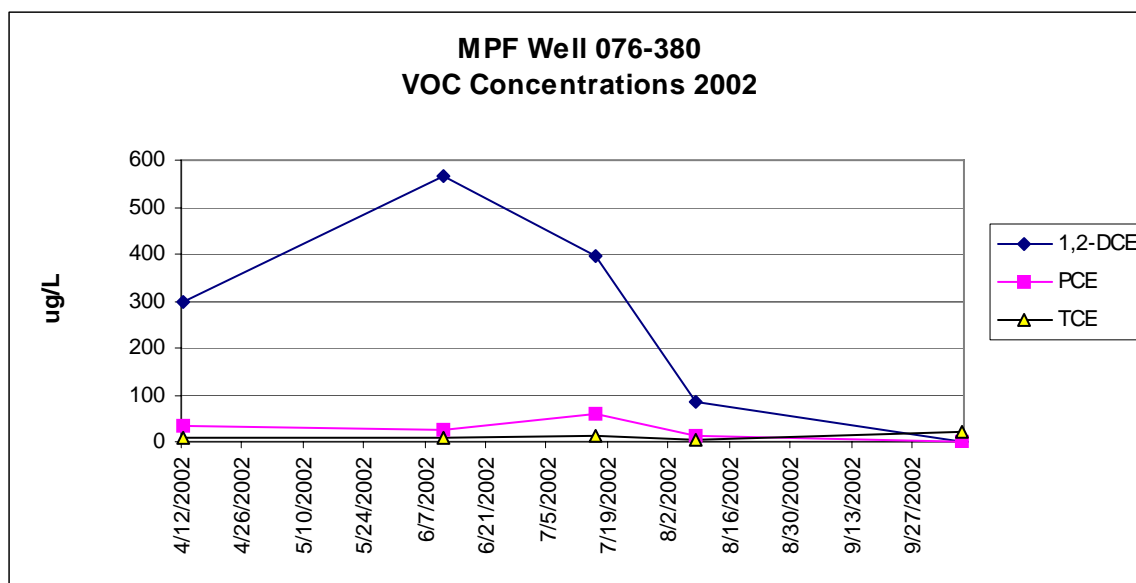


Figure 2: Trend of VOC Concentrations in MPF Well 076-380 during 2002.